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MULTI-MEDIA BROADCAST AND MULTICAST SERVICE (MBMS) IN A WIRELESS COMMUNICATION SYSTEM

CLAIM OF PRIORITY UNDER 35 U.S.C. §120

The present application for patent is a Continuation and claims priority to patent application Ser. No. 11/410,580, entitled "Multi-Media Broadcast and Multicast Service (MBMS) in a Wireless Communications System" filed Apr. 24, 2006, now allowed, which is a Continuation and claims priority to patent application Ser. No. 10/140,352, entitled "Multi-Media Broadcast and Multicast Service (MBMS) in a Wireless Communications System" filed May 6, 2002, now U.S. Pat. No. 7,177,658, issued Feb. 13, 2007, and assigned to the assignee hereof and hereby expressly incorporated by reference herein.

BACKGROUND

1. Field

The present invention relates generally to data communication, and more specifically to techniques for implementing multi-media broadcast and multicast service (MBMS) in a wireless communication system.

2. Background

Wireless communication systems are widely deployed to provide various types of communication such as voice, data, and so on. These systems may be multiple-access systems capable of supporting communication for multiple users and may be based on code division multiple access (CDMA), time division multiple access (TDMA), frequency division multiple access (FDMA), or some other multiple access techniques. CDMA systems may provide certain advantages over other types of system, including increased system capacity.

A wireless communication system may be designed to provide various types of services. These services may include point-to-point services, or dedicated services such as voice and packet data, whereby data is transmitted from a transmission source (e.g., a base station) to a specific recipient terminal. These services may also include point-to-multipoint services, or broadcast services such as news, whereby data is transmitted from a transmission source to a number of recipient terminals.

The characteristics and requirements for broadcast services are very different in many aspects from those for dedicated services. For example, dedicated resources (e.g., physical channels) may be required to be allocated to individual terminals for dedicated services. In contrast, common resources may be allocated and used for all terminals expected to receive the broadcast services. Moreover, the transmission for a broadcast service would need to be controlled such that a large number of terminals are able to reliably receive the service, while minimizing the amount resources required to implement the service.

There is therefore a need in the art for techniques to implement MBMS services, which comprise broadcast and multicast services, in a wireless communication system.

SUMMARY

Techniques are provided herein to implement MBMS services in a wireless communication system. These techniques cover various aspects of point-to-multipoint transmissions for broadcast and multicast services.

In one aspect, a method is provided for processing data for transmission to a plurality of terminals (or UEs). In accordance with the method, a plurality of frames of information

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bits is provided to a buffer implementing a matrix. The frames may have variable rates and each frame may include a particular number of information bits that is different from those of other frames provided to the matrix. The matrix is padded with padding bits based on a particular padding scheme to support variable rates for the frames. The frames of information bits are then coded based on a particular (block) code to provide a plurality of parity bits. The frames of information bits and the parity bits are then transmitted to the terminals.

In another aspect, a method is provided for controlling the transmit power of a (broadcast or multicast) data transmission to a plurality of terminals. In accordance with the method, a plurality of uplink transmit power control (TPC) streams is received from the terminals. The uplink TPC streams are then processed to obtain a stream of joint power control commands for the data transmission. The transmit power of the data transmission is then adjusted based on the stream of joint power control commands.

In one embodiment, a single uplink TPC stream is received from each terminal. The single uplink TPC stream would include power control commands for controlling transmit powers of multiple downlink data transmissions to the terminal, one of which is the (broadcast or multicast) data transmission to the plurality of terminals. In an embodiment, the single uplink TPC stream from each terminal includes a power control command for each power control interval, which is set to increase transmit power if an increase in transmit power is needed for any of the multiple downlink data transmissions. The joint power control command for each power control interval may then be determined based on "OR-of-the-UP" commands in the uplink TPC streams received from the terminals for that power control interval.

A downlink TPC stream is also typically transmitted for each terminal. The downlink TPC streams for the plurality of terminals may be transmitted in a multiplexed (e.g., time-division multiplexed) manner on a single power control channel.

Various aspects and embodiments of the invention are described in further detail below. The invention further provides methods, program codes, digital signal processors, receiver units, transmitter units, terminals, base stations, systems, and other apparatuses and elements that implement various aspects, embodiments, and features of the invention, as described in further detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

The features, nature, and advantages of the present invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings in which like reference characters identify correspondingly throughout and wherein:

FIG. 1 is a diagram of a wireless communication system that may implement various aspects and embodiments of MBMS;

FIG. 2 is a simplified block diagram of an embodiment of a base station and a terminal (or UE);

FIG. 3 is a diagram of the signal processing at the base station for a downlink data transmission, in accordance with W-CDMA;

FIGS. 4A through 4F are diagrams illustrating six outer code designs, whereby zero padding is used to facilitate variable-rate outer coding;

FIGS. 5A through 5C are diagrams illustrating channel models for (1) simultaneous reception of a multicast channel